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CLAIMS

That which is claimed is:

1. A steerable balloon catheter having a deflectable tip which comprises:

an inner elongated flexible tubing having proximal and distal portions;

a flexible helical coil having proximal and distal ends, the proximal end of said helical coil is attached to the distal portion of the flexible tubing;

an elongated deflection member having proximal and distal portions and being slidably disposed within said tubing and within said helical coil, the distal portion of said deflection member being flattened to form a deflection ribbon which extends in a plane;

a retaining ribbon having proximal and distal ends, the proximal end of the retaining ribbon is attached to the distal portion of the flexible tubing and the retaining ribbon is oriented to extend in a plane which is generally parallel to the plane of the deflection ribbon;

an attachment member engaging the distal end of the helical coil, the distal portion of the deflection member and the distal end of the retaining ribbon so that longitudinal movement of the deflection member in a distal direction causes the distal end of the helical coil to be deflected in one direction and longitudinal movement of the deflection member in a proximal direction causes the distal end of the helical coil to deflect in another opposite direction;

an outer elongated flexible tubing surrounding the inner elongated tubing so as to define a passageway between the outer tubing and the inner tubing; and,

an inflatable balloon mounted on the outer flexible tubing and communicating with the passageway between the outer tubing and the inner tubing.

2. A steerable balloon catheter as defined in Claim 1, wherein the retaining ribbon and the deflection ribbon are normally biased in an arcuate configuration to thereby cause the distal end of the helical coil to be normally biased in a curved shape.

3. A steerable balloon catheter as defined in Claim 1, wherein the proximal portion of said deflection member is of a circular cross section which extends from the proximal portion of the inner flexible tubing to approximately the distal portion of the inner flexible tubing.

4. A steerable balloon catheter as defined in Claim 3, wherein the proximal end of said retaining ribbon extends from the distal portion of the inner flexible tubing to approximately the distal end of the flexible helical coil.

5. A steerable balloon catheter as defined in Claim 1, wherein the attachment member takes the form of a rounded bead.

6. A steerable balloon catheter as defined in Claim 5, wherein the rounded bead is formed with an epoxy material.

7. A steerable balloon catheter as defined in Claim 1, wherein the attachment member takes the form of a rounded bead which contacts the distal end of the helical coil to define a circular surface at the distal end of the coil and the deflection ribbon engages the rounded bead at a location offset from the center of the circular surface of the rounded bead.

8. A steerable balloon catheter as defined in Claim 7, wherein the distal end of the retaining ribbon engages the rounded bead at a location offset from the center of the circular surface of the rounded bead.

9. A steerable balloon catheter as defined in Claim 8, wherein the distal end of the retaining ribbon engages the rounded bead at a location offset from the center of the circular surface in an opposite direction from the offset location of the deflection ribbon.

10. A steerable balloon catheter as defined in Claim 9, wherein the deflection member and the retaining ribbon are joined to each other within the rounded bead.

11. A steerable balloon catheter as defined in Claim 10, wherein the deflection ribbon and the retaining ribbon are formed as a single unitary element.

12. A steerable balloon catheter as defined in Claim 11, wherein the deflection ribbon and the retaining ribbon are joined to form a generally U-shaped configuration to thereby provide a predetermined spacing between the deflection ribbon and the retaining ribbon and to maintain the deflection ribbon and the retaining ribbon in planes which are parallel to each other.

13. A steerable balloon catheter as defined in Claim 12, wherein the deflection ribbon is formed by flattening an intermediate portion of the deflection

member and the retaining ribbon is formed by flattening the distal portion of the deflection member.

14. A steerable balloon catheter as defined in Claim 13, wherein the retaining ribbon is of a thickness which is less than the thickness of the deflection ribbon.

15. A steerable balloon catheter as defined in Claim 14, wherein the deflection ribbon is of a thickness equal to about .002 inches and the retaining ribbon is of a thickness equal to about .0015 inches.

16. A steerable balloon catheter having a deflectable tip which comprises:

an inner elongated flexible tubing having proximal and distal portions;

a flexible helical coil having proximal and distal ends, the proximal end of said helical coil is attached to the distal portion of the flexible tubing;

an elongated deflection member having proximal and distal portions and being slidably disposed within said tubing and within said helical coil, the distal portion of said deflection member being tapered;

an elongated retaining member having proximal and distal ends, the proximal end of the retaining member is attached to the distal portion of the flexible tubing;

an attachment member engaging the distal end of the helical coil, the deflection member and the distal end of the retaining member so that longitudinal movement of the deflection member in a distal direction causes the distal end of the helical coil to be deflected in one direction and longitudinal movement of the

deflection member in a proximal direction causes the distal end of the helical coil to deflect in an opposite direction;

an elongated flexible tubing surrounding the inner elongated tubing so as to define a passageway between the elongated flexible tubing and the inner elongated tubing; and,

an inflatable balloon mounted on the outer elongated tubing and communicating with the passageway between the outer tubing and the inner tubing.

17. A steerable balloon catheter as defined in Claim 16, wherein the retaining member is pre-shaped in an arcuate configuration to thereby cause the flexible helical coil to be normally biased into a curved shape.

18. A steerable balloon catheter as defined in Claim 17, wherein the attachment member takes the form of a rounded bead.

19. A steerable balloon catheter as defined in Claim 17, wherein a portion of the attachment member extends across the distal end of the helical coil, the distal portion of the deflection member engages the attachment member at a location offset from the center of the attachment member extending across the distal end of the helical coil.

20. A steerable balloon catheter as defined in Claim 19, wherein the distal end of the retaining member engages the attachment member at a location offset from the center of the attachment member extending across the distal end of the helical coil.

21. A steerable balloon catheter as defined in Claim 20, wherein the distal end of the retaining member engages the attachment member at a location offset from the center of the attachment member in an opposite direction from the offset location of the deflection member.

22. A steerable balloon catheter as defined in Claim 21, wherein the deflection member and the retaining member are joined to each other within the attachment member.

23. A steerable balloon catheter as defined in Claim 22, wherein the deflection member and the retaining member are formed as a single unitary element.

24. A steerable balloon catheter as defined in Claim 23, wherein the junction between the deflection member and the retaining member form a generally U-shaped configuration to thereby provide a predetermined spacing between the distal portion of the deflection member and the distal end of the retaining member.

25. A steerable balloon catheter as defined in Claim 24, wherein the attachment member takes the form of a rounded bead.

26. A steerable balloon catheter having a deflectable tip which comprises:

a first elongated flexible tubing having proximal and distal portions;

a flexible helical coil having proximal and distal ends, the proximal end of said helical coil is attached to the distal portion of the flexible tubing;

an elongated deflection member comprised of proximal and distal portions and being slidably disposed within said tubing and within said helical coil, the proximal portion of the deflection member being of a cylindrical cross section and the distal portion of said deflection member takes the form a deflection ribbon which extends in a plane;

a retaining ribbon having proximal and distal ends, the proximal end of the retaining ribbon is attached to the distal portion of the flexible tubing and the retaining ribbon is oriented to extend in a plane which is generally parallel to the plane of the deflection ribbon;

an attachment member engaging the distal end of the helical coil, the distal portion of the deflection member and the distal end of the retaining ribbon so that longitudinal movement of the deflection member in a distal direction causes the distal end of the helical coil to be deflected in one direction and longitudinal movement of the deflection member in a proximal direction causes the distal end of the helical coil to deflect in another opposite direction;

a second elongated flexible tubing attached to and supported by said first tubing, said second tubing having an inflation lumen; and,

an inflatable balloon mounted on said second elongated flexible tubing and communicating with the lumen of said second elongated tubing.

27. A steerable balloon catheter as defined in Claim 26, wherein the retaining ribbon and the deflection ribbon are normally biased in an arcuate configuration to thereby cause the distal end of the helical coil to be normally biased in a curved shape.

28. A steerable balloon catheter as defined in Claim 26, wherein the distal portion of the deflection member and the deflection ribbon are formed from a wire of a circular cross section and in which the distal portion is flattened to form the deflection ribbon.

29. A steerable balloon catheter as defined in Claim 28, wherein the attachment member takes the form of a rounded bead which contacts the distal end of the helical coil to define a circular surface at the distal end of the coil and the deflection ribbon engages the rounded bead at a location offset from the center of the circular surface of the rounded bead.

30. A steerable balloon catheter as defined in Claim 29, wherein the distal end of the retaining ribbon engages the rounded bead at a location offset from the center of the circular surface of the rounded bead.

31. A steerable balloon catheter as defined in Claim 30, wherein the distal end of the retaining ribbon engages the rounded bead at a location offset from the center of the circular surface in an opposite direction from the offset location of the deflection ribbon.

32. A steerable balloon catheter as defined in Claim 31, wherein the deflection member and the retaining ribbon are joined to each other within the rounded bead.

33. A steerable balloon catheter as defined in Claim 32, wherein the deflection ribbon and the retaining ribbon are joined to form a generally U-shaped configuration to thereby provide a predetermined spacing between the deflection ribbon and the retaining ribbon and to maintain the deflection ribbon and the retaining ribbon in planes which are parallel to each other.

34. A steerable balloon catheter as defined in Claim 33, wherein the deflection ribbon is formed by flattening an intermediate portion of the deflection member and the retaining ribbon is formed by flattening a distal portion of the deflection member.

35. A steerable balloon catheter as defined in Claim 34, wherein the retaining ribbon is of a thickness which is less than the thickness of the deflection ribbon.

36. A steerable balloon catheter as defined in Claim 26, wherein the proximal portion of the elongated flexible tubing is coupled to a control handle and the elongated deflection member is mounted with the control handle for longitudinal movement.

37. A steerable balloon catheter as defined in Claim 36, wherein said control handle includes a movable knob which is coupled to the elongated deflection member for longitudinal positioning of the deflection member.

38. A steerable balloon catheter as defined in Claim 37, wherein said control handle is coupled to the elongated flexible tubing with a release mechanism so that the handle may be removed from the guidewire.

39. A steerable balloon catheter as defined in Claim 38, wherein the elongated deflection member extends through the entire length of the control handle and beyond a proximal end of the control handle.